STRATIGRAPHICAL CONSTRAINS ON THE DURATION OF TESSERA FORMATION: PRELIMINARY RESULTS OF THE REGIONAL MAPPING OF VENUS. M.A.Ivanov[1] and J.W.Head[2]; 1- Vernadsky Institute, Russia Academy of Sci., 117975; 2- Dept. of Geol. Sci, Brown Univ., Providence, RI 02912

Introduction Tessera is a geologic unit, the surface of which is heavily deformed by tectonics [1-4]. By definition, two sets of tectonic features must be on the tessera surface. Besides tessera, there are other tectonically deformed terrains on Venus. However, they possess simpler structural patterns compared with tessera. The geological mapping of many areas on Venus has shown that the tessera with its characteristic tectonic pattern (normal tessera) always makes up the base of the local and regional stratigraphic columns [5-11] even though there are several different styles of tectonic activity [4,12]. Such a stratigraphic position gives the possibility to date the tectonic episode of tessera formation as occurring at the beginning of the visible geologic history of Venus [10,11].

We have conducted detailed geologic mapping in a zone from 0 to 360E, 22.3 - 37.6N. The mapping showed that there are terrain types the tectonic pattern of which satisfies the formal definition of tessera but is simpler and morphologically close to the pattern of younger and less deformed units. This terrain, quasitessera or tessera-like terrain, may both represent facies of the normal tessera and illustrate stages of tessera formation. Analysis of quasitessera morphology, geologic position, and areal distribution could help to answer the question: How did the intensity of tessera formation change through the visible part of Venus' geologic history?

Global stratigraphic scheme To answer the above question it is necessary to understand the stratigraphic position and morphologic nature of quasitessera. The stratigraphic column consists of the units which are as follow (from older to younger) [10,11,13,14]. *Tessera terrain* (Tt). *Densely fractured plains* (Pdf) are the plains deformed by dense and narrow parallel fractures. Pdf embays tessera and is embayed by younger plains. *Fractured and ridged plains* (Pfr) / *Ridge Belts* (RB) presented by plains occasionally deformed by broad ridges. RB are tectonic facies of Pfr characterizing by densely packed broad ridges. Pfr/RB embayed by younger plains and embays Tt and Pdf. *Fracture Belts* (FB). This unit had formed by disruption of the older material units. The unit presented by swarms of fractures and graben. *Shield plains* (Psh) presented by plains with numerous shield-like features. Psh embays Pdf, Pfr, and the majority of the FB and is embayed by younger plains. *Plains with wrinkle ridges, lower and upper members* (Pwr1-2) are morphologically smooth plains moderately deformed by wrinkle ridges. Plains with wrinkle ridges embay the all above units. *Lobate plains and Smooth plains* (Pl/Ps) have morphologically smooth surface mostly undisturbed by tectonic features. Pl/Ps embays wrinkle ridges of Pwr.

Description of the tessera/ nontessera transitions. ***C1-30n009:*** There are fragments of elevated terrain with rough surface typical of tessera. However, the terrain has only one set of deformation (fractures) which is characteristic of Pdf. ***C1-30n027:*** There are Tt, Pdf, and Pfr and there is no quasitessera here. ***C1-30n 045:*** Tt, Pdf, and Pfr are presented here. One fragment of Pdf is cut across by a graben. The graben complicates the fragment's surface and makes it to be looking like tessera. There is no transition between tessera and Pfr/ RB. ***C1-30n063:*** There are occurrences of Tt, Pdf, and Pfr. In several places contacts between Tt and Pfr are gradual. Some occurrences of Pfr look like tessera due to their brightness and complex deformational pattern but there is no gradual transitions between Tt and Pdf. ***C1-30n081:*** Tt presented by the southern portion of Tellus, boundary of which is heavily embayed by the variety of units. Pfr embays the tessera. At the contact both Tt and Pfr are cut by fractures which make the Pfr pieces to be looking like tessera. ***C1-30n099:*** Some fragments of Pfr at the tessera boundary have two sets of structures (ridges and fractures) and resemble tessera but have lower density of tectonical structures and more regular pattern of deformation. Pdf has no the transitional facies with Tt. ***C1-30n117:*** Pfr is occasionally in contact with Tt. Sometimes the ridges typical of Pfr disrupted orthogonally by graben. This makes the occurrences of Pfr to be look like tessera. Although Pdf also occurs, the unit has no facies transitional to tessera. ***C1-30n135:*** Pdf is sometimes in contact with Tt. At the contact the chaotically deformed tessera merge gradually with Pdf which further from the contact possesses only one set of deformation. Pfr is spatially associates with tessera but has no transition facies with Tt. ***C1-30n153:*** There is no tessera in this C1. Fragments of radar bright terrain with two sets of extensional features and remnants of lava plains are visible. The terrain fits the formal definition of tessera but demonstrates more regular pattern of deformation. ***C1-30n171:*** There are Tt, Pdf, and Pfr. Small fragments inside tessera with two sets of extensional structures resemble the deformational pattern of both tessera and Pdf. There is no transition between tessera and Pfr. ***C1-30n189:*** Within the occurrences of Pfr there are areas resembling tessera by two sets of compressional and extensional features. In the contrast to tessera, the areas have diffuse boundaries. There is no transition between Tt and Pdf. ***C1-30n207:*** Pdf and Pfr have no transitions with Tt. ***C1-30n225:*** There is a little of tessera and no the transitional facies between Tt and other units. ***C1-30n243:*** There is the gradual transition between Pdf and Tt along the contacts between the units. ***C1-30n261:*** There are a few isolated fragments of terrain which shares common characteristics of

Tt and Pdf: It is radar bright, elevated, deformed by several sets of fractures, and generally has the morphology typical of the lava plains. ***C1-30n279:*** Occurrences of Pdf and Pfr have the recognisable morphology of lava plains. In several places the combination of Pdf and Pfr makes the surface strongly resembling tessera. ***C1-30n297:*** In close association with tessera there are occurrences of Pfr with gently rolling plains surface. Sometimes both tessera and Pfr deformed by graben which make the gradual transition between Pfr and Tt. ***C1-30n315:*** Pdf and Pfr occasionally look like tessera because they are radar bright, complexly deformed, and elevated. Deformation, however, is more regular than that typical of tessera. ***C1-30n 333:*** The terrain which looks to be transitional to tessera occurs where the fractures typical of Pdf are bent. This complicates the more regular pattern of the unit's deformation. ***C1-30n351:*** There is no the transitional terrain between Pdf and Pfr and tessera.

Discussion Quasitessera, the morphology of which resembles tessera but has a simpler structural pattern, occurs within Pdf and Pfr units. Within the mapped area there is evidence that these units embay tessera and thus are younger than both tessera material and tessera-forming tectonics. It means that this tessera-like terrain represents relatively late tectonic activity in the earliest observable history of Venus. The upper stratigraphic limit of this activity, however, is at the position of Psh and Pwr1 units because they are lightly deformed, mostly by wrinkle ridges. There are two important characteristics of quasitessera illustrating how the tessera-forming deformation changed through time.

1) The total area of the normal tessera is about 8% of the mapped area and the total area of quasitessera is significantly less than 1%. The typical size of the tessera-like occurrences is a few tens of km and their area is about several hundred of km2. In contrast, typical dimensions of the normal tessera massifs are about 100 by 200 km and their typical area is about 57,000 km2. The largest tessera regions are as large as a few thousand km across and have typical area about several million km2 [4]. This comparison shows that the typical dimensions of quasitessera are two and more orders of magnitude smaller than the typical dimensions of the fragments of normal tessera. The negligible combined area of the tessera-like terrain and small size of its occurrences suggests that even if quasitessera is the result of a hypothetical late phase of the tessera formation, the activity of this phase dropped down abruptly after the normal tessera had been formed.

2) The tessera-like terrain occurs within Pdf and Pfr units only complicating small portions of their surface. When Tt, Pdf, and Pfr occur together within any C1 the younger units usually embay tessera and show no evidence of quasitessera. The tessera-like terrain is visible only at some contacts between tessera and the younger units. Sometimes quasitessera is within self-standing occurrences either of Pdf or Pfr. This means that quasitessera terrain is neither a regular member of the morphological range from tessera to more simply deformed Pdf and Pfr, nor a regular member of the stratigraphic succession which begins from tessera. The appearance of quasitessera occasionally within either Pfd or Pfr, and not necessarily at the contact of these units with the normal tessera, suggests that there was no continuous, even dying out, phase of the formation of "new" tessera.

Conclusions Our detailed stratigraphic mapping of a significant portion of Venus' surface showed the nature and distribution of terrain which is sharing the morphology of both tessera and other younger tectonically deformed units. Such a terrain, quasitessera, occurs as small (a few tens of km across) areas within either Pdf or Pfr and not necessarily at their contact with the normal tessera. The upper stratigraphic limit of the quasitessera formation is Psh and Pwr1 plains. Such characteristics of the size and areal distribution of quasitessera and its geologic position strongly suggest that: 1) quasitessera formed occasionally and locally in the period after the normal tessera; 2) the formation of the old tessera and relatively young quasitessera is not linked by the continuous process; 3) the formation of tessera stopped relatively abruptly; 4) tessera represents an independent stratigraphic unit.

References: 1) Barsukov,V.L. et al. *JGR*, 91, D399, 1986, 2) Sukhanov,A.L. Tesserae In: *Venus Geology, Geochemistry, and Geophysics, V.L.Barsukov, et al. eds.*, Univ. Arizona Press, Tucson, London, 82, 1992, 3) Bindschadler,D.L. and J.W.Head *JGR*, 96, 5889, 1991, 4) Ivanov,M.A. and Head,J.W. *JGR*, 101, 14861, 1996, 5) Crown,D.A.et al. LPSC XXV (Abstr.), 301, 1994, 6) Greeley,R.et al. LPSC XXV (Abstr.), 463, 1994, 7) Head,J.W., et al. LPSC XXV (Abstr.), 529, 1994, 8) Zimbelman,J.R. LPSC XXV (Abstr.), 1553, 1994, 9) Rosenberg,L. LPSC XXVI (Abstr.), 1185, 1995, 10) Basilevsky,A.T. and Head,J.W. *EMP*, 66, 285, 1995, 11) Basilevsky,A.T. and Head,J.W. *Planet. Space Sci.*, 43, 1523, 1995, 12) Hansen,V.L. and Willis,J.J. *Icarus*, 123, 296, 1996 13) Basilevsky,A.T. and Head,J.W. *GRL*, 23, 1497, 1996, 14) Head,J.W. and Ivanov,M.A. *LPSC XXVII (Abstr.)*, 515, 1996